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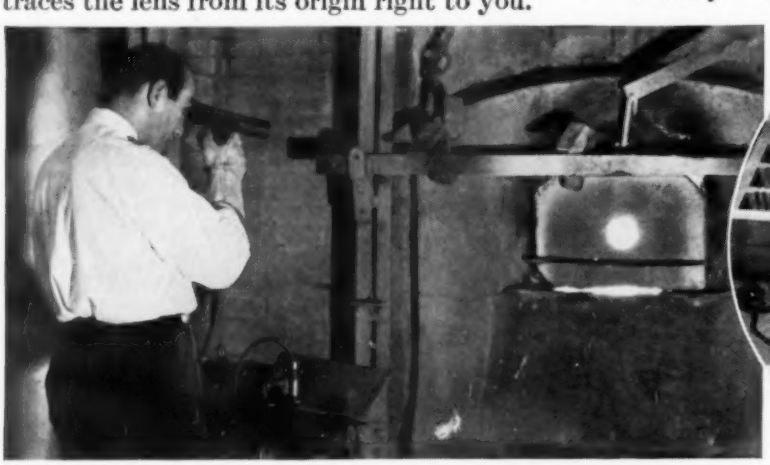

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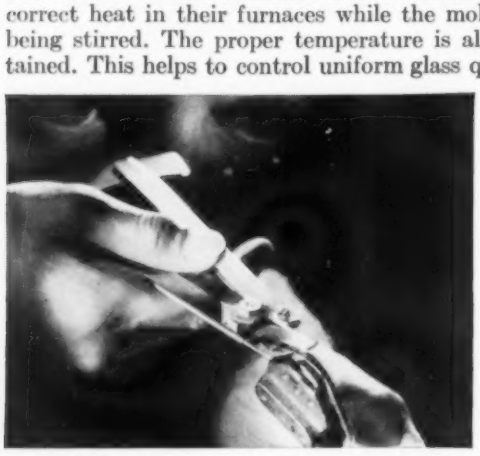

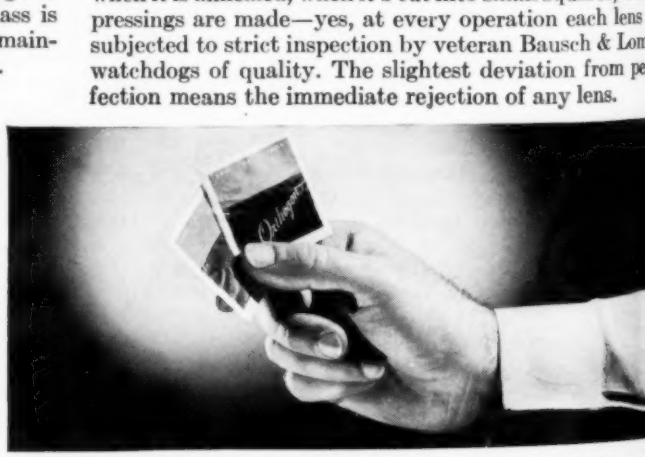

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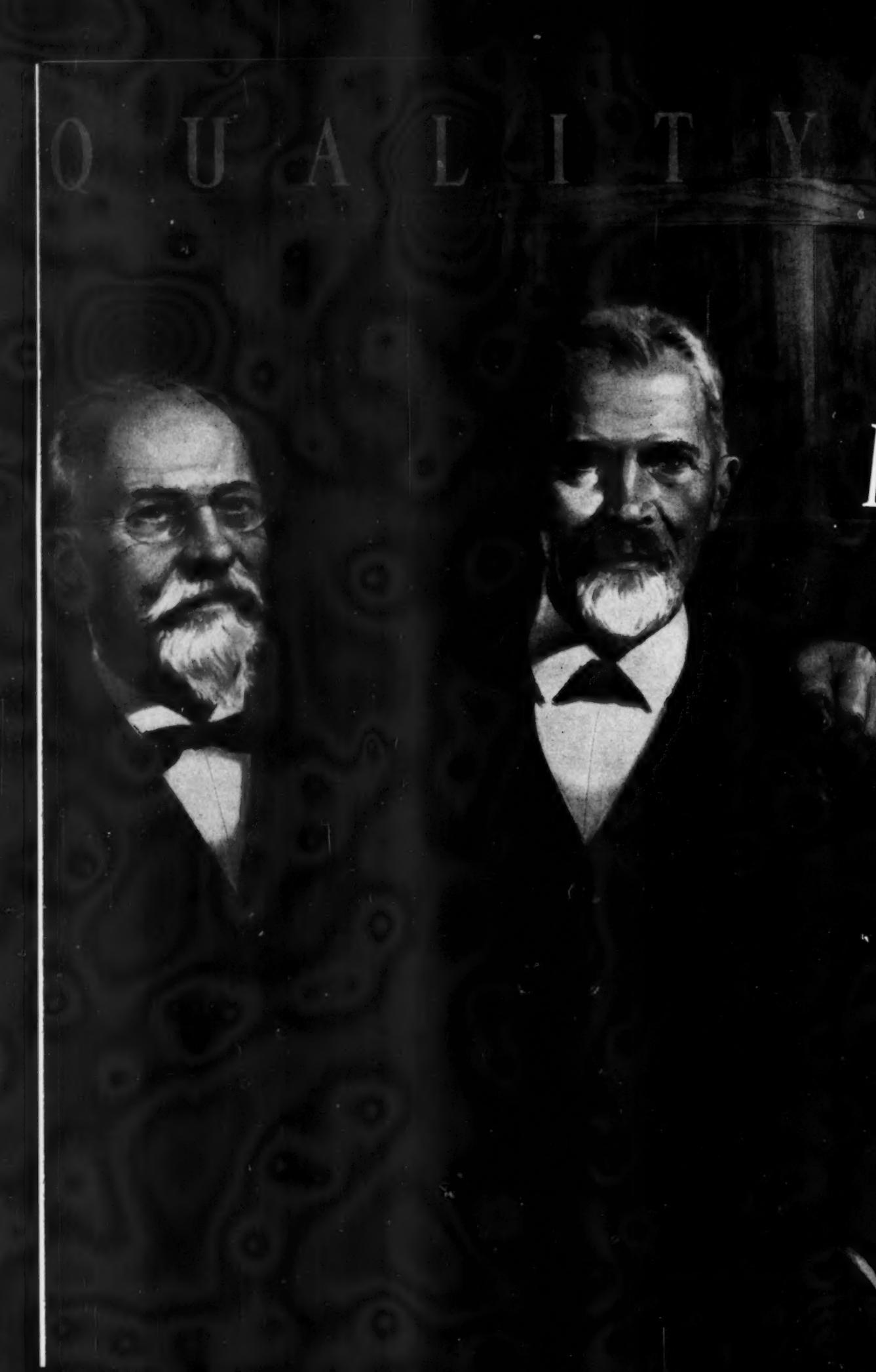
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AMERICAN JOURNAL OF OPTOMETRY

Vol. 15 FEBRUARY, 1938 No. 2

THEORETICAL AND PRACTICAL CONSIDERATIONS OF THE PULFRICH PHENOMENON*

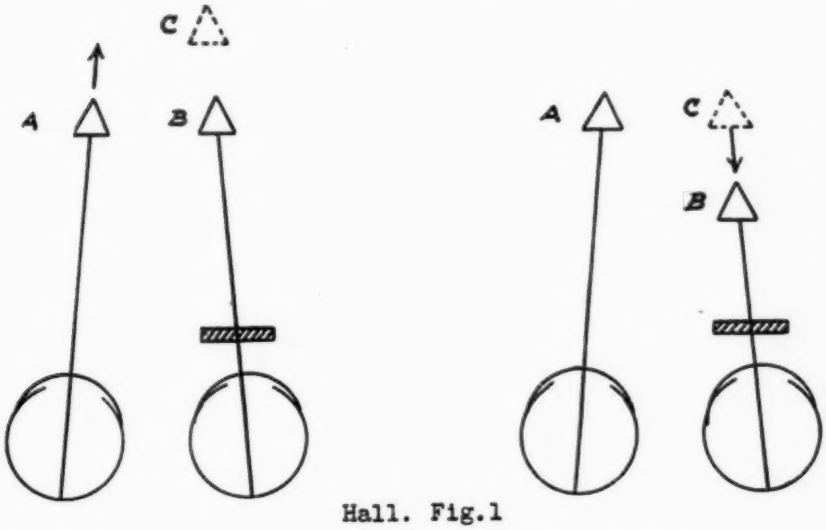
R. M. Hall
Cleveland, Ohio

If two or more objects are viewed in space, the recognition of their spatial relationship is, to a great extent, based upon the perception of depth.

That this phenomenon arises, not from one ocular function or cortical process alone but rather from a series of complex muscular, neuro-muscular and psychic adjustments, has been demonstrated. (Stevens[1], Wundt[2].)

It is, therefore, to be understood that in this paper we are concerned only with those subjective conclusions of depth which arise from alterations in visibility.

In reviewing the work of Pulfrich, Grimsdale states that the rela-



Hall. Fig.1

*An abridgment of the material presented before the American Academy of Optometry at Rochester, New York, June 25, 1937.

tive visibility of an object often influences its spatial relationship. Furthermore, if two objects of unequal visibility are viewed at a distance, the one of lower visibility will seem the more remote. These conclusions are also in agreement with those of Maddox, Stevens and others. Continuing his discussion of Pulfrich's moving pointers, Grimsdale[3] contributes the following diagrams to illustrate the effects of unbalanced visibility.

In Fig. 1 is shown the dark glass before the right eye; the two test objects at A and B; and the image of B in its faulty position at the point C.

This apparent displacement (B to C) can be measured by keeping the object on the right (the right eye being of lower visibility) at a fixed distance and moving the left (A) into the projected plane of B. It will be found that the left (A) must be moved further from the observer's eyes. If the left object is held constant, however, it will be found that B must be moved closer to the observer. Thus the phenomenon noted by Pulfrich, for moving objects, is also true of those which are stationary and becomes a criterion upon which clinical measurements can be based. That this phenomenon is due to changes in visibility alone is questionable for the factor of nasal and temporal projection[4] is also to be considered. However, changes in the relative visibility obtained by the two eyes is disturbing and, when occurring suddenly, cause a temporary malprojection which in time may be compensated for by ocular and cortical re-adjustments. That Pulfrich's phenomenon is of definite clinical importance will be demonstrated.

Apparatus and Procedure

After comparative tests of the various clinical procedures, now in use for the determination and measurement of depth perception, the instrument finally employed was the Higley Depthescope, modified to permit an accurate control of illumination and manual adjustment of the targets by the subject.

The Luckiesh-Moss[5] visibility meter was used in obtaining all visibility data.

Two groups of five subjects each were selected. Those of the first group having a visual acuity of 6/6 or better in each eye after correction. Those of the second group manifesting a lower visual acuity in one eye. The amblyopiae ranging from 6/12 to 6/60.

Monocular and binocular visibility readings were taken using the targets of the Depthescope as test objects.

The subject was then instructed to align the objects: (1) by keeping the right target constant and moving the left; and (2) by holding the left constant and adjusting the right.

Next the visibility of one eye was progressively reduced by the interposing of neutral filters and the procedure repeated.

The filters were then removed and the instrument reset; first under 10 foot-candles and then under 1 foot-candle. The same procedure was employed with the subjects of the second group with the exception that the visibility of the better eye was reduced progressively to approximate that of the poorer eye.

DATA

TABLE I—The relationship between depth perception and relative visibility (RV) for four subjects having equal visibility of the 2 eyes.

Subject	RV OU	RV OD	RV OS	Fixed Right Variable Left	Fixed Left Variable Right
R.H.	12.0	8.0	8.0	10 —10	10—10
E.H.*	6.0	4.3	6.0	11 —10	10— 9.75
A.W.	7.63	5.8	5.4	9.3—10	10—11
N.B.	14.0	12.5	12.5	10 —10	10—10
D.H.	6.5	2.8	3.0	10 —10	10—10

*Unequal visibility after correction.

TABLE I-A—The relationship between depth perception and relative visibility (RV) for five subjects in which the visibility of one eye has been reduced.

Subject	RV OD	RV OS	Fixed Right Variable Left	Fixed Left Variable Right	RV OD	RV OS	Fixed Right Variable Left	Fixed Left Variable Right	Ocular Dominancy
R.H.	3.0	8.0	8. —10	10—12	1.5	8.0	5. —10	10—15	Left
E.H.	2.2	6.0	7. —10	10—13	1.5	6.0	1.5—10	10—18	Left
A.W.	2.3	5.4	6.1—10	10—40	1.2	5.4	0. —10	10—45	Right
N.B.	2.6	12.5	8. —10	10—12	1.4	12.5	6. —10	10—14.5	Right
D.H.	1.1	3.0	8. —10	10—12	.0	3.0	6. —10	10—14	Right

TABLE II—The relationship between depth perception and relative visibility (RV) for five subjects in which binocular visibility has been reduced by interposing absorbing and diffusing filters before the eyes.

Subject	RV OU	Fixed Right Variable Left	Fixed Left Variable Right	RV OU	Fixed Right Variable Left	Fixed Left Variable Right
R.H.	12.0	10. —10	10—10	3.2	10. —10	10—10
E.H.	6.0*	11. —10	10— 9.5	5.0	12. —10	10— 8
A.W.	7.63	9.5—10	10—11	2.6	9.5—10	10—10
N.B.	14.0	10. —10	10—10	3.4	10. —10	10—10
D.H.	6.5	10. —10	10—10	1.0	10. —10	10—10

*Unequal visibility after correction.

TABLE III—The relationship between depth perception and relative visibility (RV) for five subjects when illumination intensities were reduced from 10 foot-candles to 1 foot-candle.

	10 foot-candle			1 foot-candle		
Subject	RV OU	Fixed Right Variable Left	Fixed Left Variable Right	RV OU	Fixed Right Variable Left	Fixed Left Variable Right
R.H.	12.0	10. —10	10—10	12.0	10. —10	10—10
E.H.	6.0*	11. —10	10— 9.5	6.0	11. —10	10— 9.0
A.W.	7.63	9.5—10	10—10	7.63	9.0—10	10—10.5
N.B.	14.0	10. —10	10—10	14.0	10. —10	10—10
D.H.	6.5	10. —10	10—10	6.5	10. —10	10—10

*Unequal visibility after correction.

TABLE IV (A and B)—The relationship between relative visibility (RV) and depth perception for five amblyopic subjects. These measurements were made under constant illumination on the targets.

Subject	RV OD	RV OS	Fixed Right Variable Left	Fixed Left Variable Right
A.K.	4.2	6.2	6.0—10	10—14.3
A.G.	6.0	3.2	13.6—10	10— 6
R.C.	6.0	8.0	7.0—10	10—12
B.S.	13.0	6.8	13.0—10	10— 2.3
D.R.	9.5	16.0	8.6—20	20—38.0

TABLE IV-A

Subject	RV OD	RV OS	Fixed Right Variable Left	Fixed Left Variable Right
A.K.	4.2	5.0	8.0—10	10—11.5
A.G.	5.3	3.2	13. —10	10— 6.3
R.C.	6.0	7.0	8. —10	10—11
B.S.	11.5	6.8	12. —10	10— 6
D.R.	9.5	14.0	13. —20	20—31

TABLE IV-B

Subject	RV OD	RV OS	Fixed Right Variable Left	Fixed Left Variable Right
A.K.	4.2	2.0	? —10	10— ?
A.G.	2.5	3.2	9.5—10	10— 7.3
R.C.	6.0	6.4	9.0—10	10—10.5
B.S.	7.0	6.8	10. —10	10— 8
D.R.	9.5	12.5	15.6—20	20—27

Theoretical and Clinical Interpretation

It will be noted from Table I that all subjects possessing approximately equal visibility in both eyes also have normal[6] depth perception. It is also obvious from the data of Table I and I-A that depth perception is diminished when the binocular visibility relationship is altered. For example, for subject R.H. the alteration of visibility from O.D. 8.0 and O.S. 8.0 to O.D. 1.5 and O.S. 8.0 resulted in a change in depth perception from 10-10 to 5-10, respectively. Furthermore, the data of Table II indicate that, when visibility was depressed equally in both eyes, no change of depth perception occurred. Similar results were also obtained by reducing the overall illumination intensities from 10 foot-candles to 1 foot-candle while maintaining equal visibility of the two eyes, as will be noted from Table III. Finally the data of Tables IV, IV-A and B indicate that in all cases depth perception increased as the visibility of the two eyes became more nearly equal.

It may be concluded from the pregoing that:

1. Balanced binocular visibility is essential to good depth perception.
2. Unequal visibility of the two eyes results in errors in depth perception. Hence it follows that poor depth perception may be an indication of unbalanced visibility.
3. Accurate perception of depth is independent of the degree of visibility.
4. The Pulfrich stereo-phenomenon is of theoretical significance in that it provides a basis for the interpretation of the present data.

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A STUDY OF THE TRAINING GIVEN STUDENT OPTOMETRISTS IN THE FIELD OF DIAGNOSIS OF EYE PATHOLOGY AND RELATING GENERAL DISEASE

A STUDY WHICH INDICATES THAT OPTOMETRISTS ARE SUCCESSFULLY TRAINED TO DETECT OCULAR PATHOLOGY

Introduction

For a considerable number of years[1] optometrists have practiced as refractionists. During this time the art and science of ocular refraction has made many important advances, and as technical developments came into being, these were incorporated into the refractive routines of optometrists until today as a group, these men are as thoroughly trained as any body of practitioners in the limited specialty which is theirs. Through their educational centers and in the graduate work done with the practitioners themselves, every new refractive development has been placed before the profession in a manner which has been both thorough and all embracive.

[1] The oldest optometric organization still in existence was founded by Royal Charter in 1629.

The last twenty years particularly have seen a marked change in the examination techniques used by optometrists. Instruments have improved, until today objective examination procedures have entirely eliminated the old time guess-work of the subjective test-chart era. In fact today, the entire technique of the modern optometrist bears but little resemblance to that of several decades ago. This is true in every particular but one.

While there have been great changes in the methods and techniques employed by optometrists in making ocular examinations, one important optometric idea or theory has remained as a keystone in the arch of this branch of the healing science, and that is this — it is unnecessary to use drugs in the examination of the eye. Optometrists themselves are not to be confused with "drugless healers." In fact, medicine and particularly that branch of medical science known as ophthalmology has no more loyal group of supporters than are the optometrists of today. That is evident from the close manner in which the two groups cooperate in the handling of patients in whom optometrists have discovered some form of disease or in whom they suspect of having incipient pathology, either general or ocular.

As we have said, however, one predominating idea in the technical structure of the profession, when the first Optometry Law was passed 38 years ago, was, that satisfactory eye examinations could be made without resorting to the use of "drops" or, as they are more properly called, cycloplegics. Optometrists then, as now, did not believe that the routine use of cycloplegics in eye examination work was of value. Every scientific advancement that has been made in this field since this time has done much to strengthen this belief, and the recent scientific analysis of the use of cycloplegics, made by Tait and Sinn[2] in the physiological laboratories supports this contention to the fullest degree.

Thus, while in no way opposed to therapeutic measures, optometrists practiced their refractive techniques without using cycloplegics to paralyze, or render ineffective, the action of the ciliary muscle while the refractive status of the eye was being investigated. Also, in their diagnostic work, optometrists examined the interior of the eye without using mydriatics to dilate or enlarge the pupil. In both of these particulars it was then and is now felt that other procedures accomplished the desired purpose in a more accurate manner and in one which resulted in less

[2] A preliminary report on the variations in ciliary muscle tonus with the use of homatropine. Edwin Forbes Tait and F. W. Sinn. American Journal of Optometry. Vol. 13, No. 4, pp. 140-148. 1936.

danger and inconvenience to the patient.

From the standpoint of the public, there has developed a very wide spread acceptance of these views. This is an outgrowth of the generally high standard of refractive work done by optometrists. Among oculists too, these non-cycloplegic refraction techniques, as used in the offices of optometrists, have found in many quarters, ready acceptance. This is true to such a large degree that today one finds many medical eye men using but little drugs in their refractive work.

There are, however, a group of oculists who still cling to the use of cycloplegics and mydriatics when examining eyes. Among this group will be found those, who take the extreme position that unless a drug is used, the quality of the work in some way suffers. As has been said, Tait and Sinn completely proved that the use of homatropine as a cycloplegic did more to confuse the examiner than it does to assist him, and as homatropine is the drug usually employed to paralyze the ciliary muscle, by those who use the technique, we can entirely disregard their statements in this department of the work. It is also somtimes said, by this same small group, that unless "drops" or a mydriatic is employed to dilate the pupil, in making an ophthalmoscopic examination of the interior of the eye, the work cannot be done properly. These men at times take the position, that as optometrists do not employ drugs, they cannot therefore be sufficiently educated to do this technical work with the care and skill with which it should be done. It is to study and discuss all phases of this question that this report has been prepared.

The Professional Duties of the Optometrist

Rosen comments on the critical attitude of some, toward the work done by optometrists, AMERICAN JOURNAL OF OPTOMETRY, Vol. 14, No. 9, pp. 340-342. He says, "Another criticism of optometry has to deal with the optometrist's ability to diagnose pathology. Just why this should be so is a question I cannot answer as the optometrist's training has been the very best in this field. The majority of pathology affecting the eyes is revealed by use of the ophthalmoscope. A recent graduate of one of the large eastern medical schools told me that he had had the use of an ophthalmoscope for but a few hours of actual use during his entire medical course, and that he still did not know how to use it, whereas an optometric student uses an ophthalmoscope clinically for two years before he graduates, and all during this time he is studying ocular pathology as well as general pathology," and he adds further that, "Optometrists as a

body are the best trained men in the world today to differentiate the normal eye from the one suffering from pathology, and because of the inferior work of a few of the commercial men, feel this last criticism to be unjustified."

That optometrists are well trained in the techniques employed to differentiate the normal eye, free from evidence of either ocular or general pathology, from those small number of cases in which there is either direct or indirect evidence of pathology, we will show later on in this report. Let us first concern ourselves with the duties of the optometrist. Let us review in some detail the professional work he is expected to do with skill and the work he is trained to do, with considerable thoroughness by the universities and colleges now training optometrists in their professional courses.

Just what are the professional duties of the optometrist? To understand this question we must first consider the matter of the field he is to occupy and the part he is to play in this small division of general health work that has been alloted to him. His primary duty is that of correcting errors of refraction and imbalances of the accomodation-convergence relationships. In other words, he is to correct errors of refraction which in some way affect vision and he is also to correct ocular neuro-muscular involvements which also have a bearing on experiencing normal comfortable vision when using the eyes at the near point. These are his duties as prescribed by laws in every state in this union.

It at once becomes obvious that this cannot be done with any degree of satisfaction or with any degree of assurance that it is being done properly, unless the optometrist also includes in his examination routine, such tests as would indicate and thus eliminate those few patients who were suffering from ocular pathology or from a reflex eye symptom of some remote general involvement from among those many who were suffering only from an uncorrected error of refraction and possibly imbalances of some of the ocular muscles.

In other words, it is the duty of the optometrist to diagnose and prescribe for errors of refraction and to correct imbalances of ocular muscles. But at the same time, it is his implied duty to do these things, only after ascertaining, to the best of his professional ability the fact that the eyes upon which he is working, are free from disease or incipient pathology which should first be treated by an oculist or a physician before the optometrist corrects the visual problems which remain.

While this is not a legal requirement, it is, from the professional standpoint and from the point of view of public well being, a fact that every ocular examination for refractive errors, should be preceded by a careful examination of the eyes with the sole purpose in mind of determining the exact status of those eyes in regard to the presence or absence of indications of pathology. Optometry has realized this fact for many years and the educational centers have sent forth thousands of capable refractionists in the form of optometrists who have been taught to first make these necessary diagnostic tests, and second and which is even harder and more important, been taught to do the skillful diagnostic work necessary to differentiate the normal eye, free from pathology, from the few abnormal pathological ones.

As we will show shortly, tests made to investigate and study the interior of the living eye by means of an instrument called an ophthalmoscope are taught to every optometrist. Also he is taught to make a searching examination or inspection of the anterior or outer portion of the eye using high magnification and focal illumination to assist him in this portion of his investigation and last he is taught to explore the visual fields by means of perimeters, a form of diagnostic technique of value in some cases of serious involvements. These are all tests used to determine the presence or absence of disease. In fact all of the diagnostic tests which can be made on the living eye fall in one or another of the three categories just mentioned, and every optometrist has been first taught and later examined by state boards on his proficiency in making these tests. In addition to these things, he is, of course, taught many modern refractive tests and corrective measures, as well as the diagnostic techniques and orthoptic treatment procedures to be used in cases of muscular imbalances.

In addition to the techniques of making the tests usually employed during an eye examination, optometrists are taught to do the more refined and discriminating detailed refractive work and the diagnostic eye procedures necessary to fully cover this field as it should be covered for the protection of the public.

In a paper entitled, An Outline of Refractive and Pathological Symptoms in the Eye with General Observations, William Smith, AMERICAN JOURNAL OF OPTOMETRY, Vol. 8, No. 3, pp. 71-80, 1931, says, "The optometrist as a specialist should understand certain manifestations of constitutional ailments by the reflex symptoms in the eyes. There need not be ocular pathology. In many instances that is absent,

until the disease has advanced considerably, and the reliance must be placed entirely on some of the refractive, muscular and pupillary reflex signs. The optometric practitioner, by the training he is receiving, is today looked upon as a diagnostician by the laity. In his capacity as a refractionist, he is constantly in contact with the patient's visual apparatus, and is, in many instances the first, and often the only one to view the interior of the eye and to observe whatever is going on there. Scientific optometric diagnosis is a science and an art. It involves knowledge, not only of the optical principles and refractive manifestations, but also of constitutional manifestations in disease. It involves interpretation of many signs and symptoms. It means investigation, by the process of deduction and elimination, into the true state of the individual's health, to observe conditions and to advise accordingly. Errors of refraction are in the great majority of cases the causative factor of eye strain, yet the small percentage of those refractive cases in which the constitutional factor is involved must not be overlooked. The latter may present differentiating signs or symptoms that place them in a category outside of pure refractive disturbances. The optometrist must be ever watchful for those types of cases, and while he is not able to offer any therapy, he should be ready to refer such cases to their proper sources for treatment."

Skeffington, in a paper on Remote Ophthalmoscopic Diagnosis, AMERICAN JOURNAL OF OPTOMETRY, Vol. 7, No. 5, pp. 265-271, 1930, says, "That optometry shall become the group to whom is allocated all eye diagnosis." In this, Skeffington means, that it is the duty of optometrists to become so proficient in their ophthalmoscopic examination of the eye that any abnormality which may be present be immediately referred to those engaged in therapeutic work. Skeffington in the paper just referred to does not suggest that the final diagnosis of ocular pathology rest with the optometrist but rather suggests that the optometrist make a searching examination of the interior of the eye with the ophthalmoscope, and then in those few cases that warrant it, call in for consultation some other diagnostician to assist if pathology is suspected.

J. T. Maxwell, M.D., in his OUTLINE OF OCULAR REFRACTION, Medical Publishing Co., Omaha, 1937, p. 275, says in this connection, "The mere observation of the fundus of an eye is not in itself a difficult procedure, but to recognize and diagnose pathological conditions in the eyeground is a life study." In this Maxwell is correct, and the time spent in optometric colleges in teaching this subject to students, indicates that as a profession, optometry is well aware of the responsibilities it has in

this particular. This is well brought out by the following quotation:

Kurtz, in THE AMERICAN JOURNAL OF OPTOMETRY, Vol. 14, No. 9, says, "And while on this matter of educational training of those engaged in ocular work it might be well to mention that outstanding and important phase of every ocular examination having to do with the diagnosis of disease. While it is true that the percentage of cases having ocular diseases is very low as compared to the large number of non-pathological eye cases, some pathology does exist, and of course this must be recognized by practitioners doing the examining. Diseases of the eye are diagnosed in several ways, one having to do with a searching examination of the interior of the eye by means of the ophthalmoscope. Another is accomplished by means of a thorough examination of the anterior portion of the eye wherein a number of reactions and inspections are made. A third has to do with the visual fields and an investigation of these. All optometrists are trained to make these tests. Trained for a period of years in the class rooms of their universities and colleges and in the large school clinics, where these tests are made on patients themselves under the direction of clinical professors having both medical and optometrical training. This ocular diagnostic training does not take place for but several weeks or at the most several months, but actually takes place for several years during which time the student familiarizes himself with every detail of these diagnostic techniques under all types of clinical and office practice. Every optometrist, and this has been true for a great number of years, has had this training and every man has passed examinations, both at school and before his State Board of Optometry to prove his proficiency in this vital diagnostic phase of eye work."

It is thus evident that as a profession, optometry has an understanding of its important duties to the public and also its responsibilities as a professional group, performing as it does, a very large majority of the eye work now being done in this country. And as we have already said at the start of this report, this refractive work was, and is done, without the inconvenience and possible danger of resorting to the use of drugs during the examination routines. The work being done better, in the opinion of most people, because of the fact that no "drops" were used.

Before leaving the subject of the professional duties of the optometrist let us turn then to the optometry law of Minnesota. This law is typical of many. It was originally passed in 1901. Rewritten in 1919 and again in 1925. As it is now in effect, we refer to CHAPTER 239, LAWS OF 1925 AS AMENDED BY CHAPTER 420, LAWS OF 1929. The

part we are interested in at present, reads as follows: "Any person shall be deemed to be practicing optometry within the meaning of this act . . . who shall employ any means for the measurement of the powers of vision or the adaptation of lenses or prisms for the aid thereof; or have in his possession testing appliances for the purpose of the measurement of the powers of vision, or diagnose any optical deficiency or deformity, visual or muscular anomaly of the human eye, or prescribe lenses, prisms or ocular exercises for the correction or relief of same, or who holds himself out as being able to do so . . . Nothing in this act shall be construed to apply to regularly licensed physicians and surgeons." Of course, there is much more to it than this. In fact, there are 14 sections, but the foregoing brief quotation indicates the scope of the work covered by optometrists.

We therefore conclude this portion of the report dealing with the professional duties of the optometrist by saying that optometrists realize that glasses are occasionally not the solution of eye troubles. Some of the ocular conditions the optometrist may be called upon to correct are due to imbalances of the accommodation-convergence relationships. In these cases orthoptic exercises are indicated. Other of the conditions which do effect the eye at times are due to disease.

This may be external and apparent to the most casual onlooker, but it also may be internal and not discoverable except by an expert ophthalmoscopic examination by a specially qualified optometrist or oculist. Optometrists are trained to realize that the eyes are not mere optical instruments, but are, in every sense, members of the body, sharing in all defects and distresses of the body. The knowledge of the eyes cannot stand apart from the knowledge of the body, and he who would be an expert in ocular problems must first have a knowledge of general anatomy and physiology as well as special training in pathology with particular reference to the eye. If the patient seeks the advice of someone without this special training and experience necessary to make a proper examination he may in all good faith be ordered to wear glasses which possibly may improve the vision to some extent, and by this very fact lull the patient into a false sense of security. The disease, whether due to the eye or to the bodily health, will thus be overlooked, and much valuable time will be lost in applying remedies with possible serious risk. These are facts taught in optometry courses, as we will show.

Eye strain is a common condition associated with all close work in

these days of high pressure. The strain may be due to a defect of the eyes, or may be due to general constitutional fatigue. Further, it can be induced by bad conditions of living, for example, too much drinking and smoking, too much confinement to a house, or alternatively, lack of proper exercise and fresh air. An incompetent person examining the eyes of a patient will be likely, and indeed, is known commonly, to prescribe glasses for each and all the abovê conditions, whereas the optometrist would eliminate first the general conditions through his case history and symptoms, his ophthalmoscopic examination of the interior of the eye and his visual field charting and secure that state of bodily health which would tend to benefit the eyes and possibly remove the necessity for glasses at all. In this he is taught to work with the family physician.

The determination of the degree of defect arising from each of these conditions is best obtained by an objective examination known as retinoscopy, which requires much experience in its practice and in which most optometrists are experts. The common subjective means of discovering the best vision with glasses by ordinary methods of refracting are full of pitfalls for the unwary, and it is by no means uncommon for a person suffering from eye-strain to get such a cramp or spasm of the internal muscles of the eyes as will deceive the inexperienced examiner and lead him to suppose that the patient is suffering from myopia or short sight. The prescription of concave lenses in such cases aggravates the trouble in every way, and here again optometrists are specially trained through the technique of dynamic skiametry to diagnose and relieve this condition.

Many cases of genuine eye-strain and of serious headache, especially when associated with close work, do not arise from these defects inherent in the eyes themselves, but they are due to defects of the muscles which coordinate the movements of the eyes. These defects are at times extremely complicated, and their correction requires the highest degree of skill on the part of the optometrist or oculist. It is almost true to say that there is a practical neglect of these most important defects on the part of those who have had no real optometric schooling.

All that has been said above applies with special importance to children. Here one finds the modern optometrist at his best. Not using "drops" or cycloplegics, the child has nothing to fear in his presence and willingly cooperates with him in his examination routine which usually requires two visits of about one hour each. No one will suggest that glasses improve the looks of a child, yet they are indispensable to some children. They

must be worn to enable these children to finish their educations—or to relieve distressing symptoms—or to prevent the visual defect from getting worse—or to improve the accommodative-convergence relationships. It is a choice of evils, and when that choice is between the wearing of a pair of spectacles or the further deterioration of vision there can be no question that it is better to have the glasses and to use them.

The question of the capability of modern optometrists to test the sight of children as well as of adults has been considered by no less than seventy governmental legislative bodies in the last 38 years. In every state of this Union; in all the territories, and by Congress for Washington, D. C.; in every province of Canada, and in almost every part of the far-flung British Empire, legislative bodies have without exception held that the optometrist has the educational qualifications and the clinical training necessary to enable those legislative bodies to designate *him* as the only specially licensed practitioner in the eye field.

Examining the Interior of the Eye Without Using "Drops"

It is sometimes said by a small, but at times militant group of oculists, that unless a mydriatic is used to dilate the pupil in making an examination of the interior of the eye, that the work will not be done well, or that in some cases it can not be done at all. Optometrists have for the most part ignored these accusations, feeling as they did, that with their superior training and because of the very large number of cases successfully handled by their group annually, that this argument was of no merit, and therefore no answer was necessary. In recent months, however, with medical and some little ocular work being done by governmental agencies, it is well to have the true facts presented regarding this matter. Let us therefore turn to a few of the really outstanding medical authorities in the ocular field and briefly review their statements as to the (1) possibility of making an examination of the interior of the eye without using "drops" or mydriatics and (2) of the practicability of doing this work in this way. We quote only medical authorities here, because the critical statement just referred to, comes from a small medical group. Many additional authorities could be quoted, both optometric and medical.

In discussing the matter of viewing the interior of the eye with the ophthalmoscope in the effort to determine the presence or absence of pathology, G. Hartridge, M.D., in his book, THE OPHTHALMOSCOPE, Churchill, London, 1907, says, "Of course in many cases no mydriatic is required, but when a thorough examination is necessary it is a great

advantage to examine the eye through a well-dilated pupil . . . But the student should learn not to rely too much upon these minor aids but accustom himself to examine the fundus in various positions and under all surroundings, with and without a mydriatic." E. G. Loring, M.D., writing on the same subject in Volume One of his work on OPHTHALMOSCOPY, Appleton & Co., London, 1893, seems to have about the same view of the subject. He says, "A great deal of prejudice exists in the minds of many writers against the use of atropine, especially when, after many years of experience they themselves have become emancipated from its use. It certainly must be admitted that it is an inconvenience to the patient for the time being . . ." Sir Stewart Duke-Elder, M.D., in the second edition of his PRACTICE OF REFRACTION, Blakiston's Son & Co., Philadelphia, 1935, page 251, seems to feel the same way about the use of a mydriatic in viewing the interior of the eye. Duke-Elder feels that while it is easier to do when the drug is used, that ophthalmoscopy is possible without it, and describes the technique. J. T. Maxwell, M.D., in his OUTLINE OF OCULAR REFRACTION, Medical Publishing Co., Omaha, 1937, says, page 278, "In order to get a good view of this important area it is best to use the indirect method (of ophthalmoscopy) or resort to a mydriatic. A 2% solution of cocaine may be used for this purpose but it must be remembered that drugs which dilate the pupil have a bad effect on persons with glaucomatous tendency."

D. T. Atkinson, M.D., in his book, THE OCULAR FUNDUS IN DIAGNOSIS AND TREATMENT, Lea & Febiger, Philadelphia, 1937, also describes both techniques of viewing the interior of the eye with the ophthalmoscope, i.e., (1) with the pupil dilated by means of a mydriatic and (2) without the use of a mydriatic through the normal pupillary area. He says, "If the patient's pupil is not dilated he should be instructed to look slightly to the side, otherwise as the beam of light falls on the macula, the pupil will contract." These quotations, all from outstanding oculists, indicate without question that an ophthalmoscopic examination of the interior of the eye *can* be made without dilating the pupil. In fact, they all describe the technique universally used by optometrists in doing this very thing. To be sure, they claim, and in this there is no dispute, that it is easier to do with the pupil enlarged by means of the mydriatic, but the fact remains that with care, a searching examination of the media and fundus can well be accomplished without resorting to the use of the drug.

Medical Opinions on the Optometrists' Ability to Diagnose Ocular Pathology

As we have indicated in the preceding section of this report, some doubt was cast on the optometrists' ability to differentiate between a normal eye and an eye suffering from some sort of ocular pathology. This statement was made, because the optometrist does not use a mydriatic or "drops" in making his examination of the interior of the eye. As in the preceding section, we will therefore quote only from medical writers regarding this point, of the ability of the optometrist to satisfactorily do this piece of diagnostic work. That he can and does do it successfully there can really be no question, as he is well trained to do it and the proof is evidenced by the small but constant number of cases referred to oculists by optometrists when pathology is found. However, because the statement has been made and in the interest of placing before interested groups the real facts, we herewith present the views of those oculists who are familiar with the true situation, and who have been willing to go on record as to the optometrists' ability to perform with success in this department of his work.

After twenty-seven years' practice in medical and surgical diseases of the eye, Dr. Frederick Stahl, M.D., of Los Angeles, California, recently announced that he would discontinue all refraction work and the prescribing of glasses, and refer all refraction cases to optometrists. THE REFRACTIONIST, June 1, 1934. In the announcement, Stahl made this statement, "I have been satisfied for many years that the modern optometrist is eminently qualified to meet the needs of the public in this respect and I shall be glad to cooperate with any reputable optometrist in the care of the eye." He also says, "There is perhaps no place where the optometrist can render a greater service to the public than in the early diagnosis of the opacities of the crystalline lens and its capsule. To begin with, the optometrist sees these cases years before the oculist gets a chance to look at them and upon the optometrist depends to a large degree the course of the cataract and the earliness or lateness of operation, if they ever come to operation."

The oculist, Tibbles, who is a member of the Examining Board of the Institute of Chemist Opticians (optometrists) in England, in charge of the examination of candidates in the matter of abnormalities and diseases of the eye, says, THE REFRACTIONIST, December 16, 1937, "Last week I could fine only one candidate out of six whom I could conscientiously mark below 70% in my section. I do not set the papers which are under the supervision of the University of London." And writing fur-

ther on the matter of the optometrist diagnosing ocular pathology, he says, "In all fairness I must say that if they meet with any abnormality they are only too pleased to send the patient to someone."

The oculist, Noyes, in a talk before the New York County Optometric Affiliates, OPTICAL JOURNAL-REVIEW, December 15, 1937, suggests that optometrists adopt a ten-point diagnostic routine as a standard part of their examination procedure. He says, "Careful observations of the ten points, plus close cooperation with the ophthalmologist, will save sight, and even life itself in some cases." Here is a case of an oculist who has been cooperating with optometric bodies to further improve the general levl of diagnostic work done by optometrists. Many similar examples could be presented.

Spitzka, according to Morris, DIOPTRIC BULLETIN, Vol. 30, No. 6, pages 306-307, says, "When an individual's vision becomes impaired, I would rather have him go to an optometrist. As an active specialist in this field he acquires a special aptitude for the manipulation of instruments and the recognition of every abnormality which only a few medical practitioners can enjoy. In the majority of cases only correcting glasses are needed. In the small minority, in which a diseased condition exists, the optometrist can be relied upon to recognize the pathologic state, and send the patient to a suitable medical practitioner."

A physician, writing in THE REFRACTIONIST, November 16, 1937, page 276, about the examination given to graduate optometrists before they are permitted to practice, says, "The standard required in this examination is very high. It differs from other optical examinations in the wider knowledge required, in what might be called the physiological subjects, both general and ocular, and in the more extensive experience necessary in refractive examinations, oculo-motor investigations, and in the techniques employed in the examination for pathological conditions. Altogether there are nine written papers, each of two hours duration, then four practical sections (in which the applicant works on patients) and then two oral sections. In clinical pathology the candidate is given one hour in which to examine three patients for abnormal conditions and write complete reports. The marking here is very severe, and one slip such as missing an opacity or a small patch in the periphery of the fundus may be sufficient to fail him. In instrumentation, he has to show a sound practical knowledge of the use of the slit lamp, a stand ophthalmoscope, perimeters and screens, and some of the instruments used in orthoptics. In clinical refraction he is given three patients on whom to carry out complete examinations (except for pathological conditions). In this section

he has to take history and symptoms, do retinoscopy and subjective test, examine for oculo-motor imbalances, and decide on a prescription. The cases chosen by the examining board are difficult ones."

In discussing the optometrists' ability to diagnose ocular abnormalities, Jas. Forrest, M.D., oculist to the Newspaper Press Fund, says in a letter to the "Times" which was reprinted in THE SOUTH AFRICAN OPTOMETRIST, October, 1937, page 108, "The official views on the claims of optometrists (or sight-testing opticians as they are sometimes called in England), to detect eye disease having been given, I should like to present a few facts that are not without interest. For many years qualified optometrists have conceded that prior to giving glasses the healthiness of the eyes must be determined. On this point they are as emphatic as an ophthalmic surgeon and their ability to detect disease, however, insidious, is not invalidated by mistakes that individuals make."

Forrest continues, "All men are fallible and the ophthalmic surgeons are no exceptions. The claims of the optometrists to detect disease are substantiated by the training they undergo at their refraction hospitals as well as other centers, and by the clinical examinations, conducted by ophthalmic surgeons, they have to pass before a diploma is granted." Forrest is here discussing the training of the British optometrist; in America the author believes the training is even more rigid, the optometry courses in the universities and colleges on this side of the water being even larger than those abroad. Forrest adds, however, "But the supreme test (of the British optometrist) has been their insurance work; how efficiently optometrists have carried out this work is shown by the attitude of the approved societies who after entrusting to optometrists for years the sight of their members, now support the claim for official recognition."

"The calamities," continues Forrest, "that those of the medical hierarchy (in England) prophesied would follow the allocation of sight testing to optometrists did not eventuate. This at least suggests that the opinion of a refractionist on the healthiness of an eye is as dependable as that of an oculist. But the detection of eye disease is a mere preliminary to the real work of the optometrist which is that of sight testing, and in this he acknowledges no superior. To surgeons this sphere has not the appeal of the pathological and, in hospitals, it is allotted to underlings. There, crowds have to be refracted under conditions not conducive to an examination that requires above all the cooperation of a patient at ease and unhurried. As a result, few of the young escape the ordeal of "drops"

—a commonplace in hospitals and in the school clinics, an exception in private."

Scientific Opinions on the Optometrists' Ability to Diagnose Ocular Pathology

Let us now turn to a consideration of this matter from the standpoint of the technical staffs of those large manufacturing companies that engage in the precision work of making diagnostic instruments. These manufacturing establishments employ on a full time basis, the services of a number of scientists whose duty it is to constantly improve the materials and instruments made by the manufacturing departments of the company. These technical staffs are drawn from all branches of science that have to do in any way with ocular work. There are medically trained men on these staffs. Optometrists will also be found. There will be a physicist or two and a man versed in the laboratory experimental work done by the applied psychologist. Several graduates in applied optics and usually a physiologist. All of these men have had graduate training and most are the holders of Ph.D. degrees. They are giving their lives to the advancement of a technical branch of optical science and are given every aid and assistance by the large companies with whom they have associated themselves. These men, as part of their work, constantly study the needs of the professional people who are using their equipment or the materials made under their supervision. They are in close touch with the practitioners in their offices and are constantly striving to make the work of optometrists and oculists more accurate and easier. This is done in two ways; first, as I have said, by improving as best they can, the instruments used in refractive and diagnostic eye work, and, second, by making technical contributions of no little value to the literature of the professions dealing with eye work.

As this paper deals with the ability of the optometrist to differentiate the normal eye from one suffering from some form of pathology, and as one of the chief diagnostic aids is an instrument known as an ophthalmoscope, it is fitting therefore, that we consider briefly the modern instrument made for use by optometrists in his refractive and diagnostic work. The modern electrical ophthalmoscope is an instrument so made that one can view the interior of the eye. Its chief purpose is to study the crystalline lens, the aqueous humor and the retinal and choroidal coats of the eye. These portions of the eye can be viewed in no way other than by means of the opthalmoscope.

Now it is sometimes said that it is an impossibility to examine the

interior of the eye without using a drug known as a mydriatic to enlarge the pupil through which one must look if the interior of the eye is to be seen. As we have pointed out this is not the case, as thousands and thousands of optometrists have been trained to do this very thing without using the drug, and do it successfully as hundreds of oculists will testify, to whom these optometrists have referred cases, in which they have discovered signs of disease as they made their ophthalmoscopic examinations.

For the last twenty years at least, ophthalmoscopes have been made in which the light source which is used to illuminate the interior of the eye comes directly from the instrument itself, it being connected to a rheostat, or else having small electrical batteries placed in its handle. Prior to this important improvement, the light was reflected by means of mirrors on the ophthalmoscope, into the eye under observation. Obviously this new development was a big step forward and made the technique of investigating the interior of the eye very much easier. Along with this technical improvement of the light source came also an improvement of the design and construction of the instrument itself, making the modern ophthalmoscope such a splendid instrument which can be used with such complete ease, that the old time techniques of using "drops" or mydriatics to dilate the pupil are no longer necessary in this part of the examination of an eye.

As we have just said, it is no longer necessary to use atropine, homatropine or cocaine as a mydriatic to dilate the pupil because of the improvement in instrumentation which has come into being through the efforts of the scientific staffs connected wth those people who make ophthalmic equipment. That this is true, there can be no question. It is also a fact, however, that optometrists themselves, as we will show, are also better trained to do this work than they were some thirty years ago.

To return, however, to the technical staffs of scientists who devised the modern ophthalmoscopes. Let us hear from one such group, who in VISION, Vol. 22, No. 4, pages 12-13, 1938, have this to say on the subject of the optometrist, and the diagnostic work he does with an ophthalmoscope. "Knowledge of ophthalmoscopy is a legal requirement in every state. (Laws governing the practice of optometry). No eye man can obtain a license to practice (as an optometrist) today unless he displays such knowledge. And the comprehensive, all-embracing scope of the science of ophthalmoscopy certainly makes the use of an ophthalmoscope a moral obligation . . . State boards (of optometry) everywhere insist that an applicant for an examiner's license shall have knowledge of ophthalmoscopy, which means skill in using the instrument, and ability

to recognize those tell-tale departures from healthy normality which reveal diseased conditions."

They continue, "There are, obviously, two reasons why all men should practice ophthalmoscopy, aside from the plain intention of the state (optometry) laws requiring knowledge of the science. The first, more important reason, of course, is the protection of the patient. A condition of the fundus which points to albumen in the blood stream or indicates diabetes, high blood pressure, hardening of the arteries or other serious ailment should be a veritable red flag to the examiner—a positive "must" that the patient receive immediate medical attention."

"The second reason is protection of the practitioner himself from attack upon his professional capability and from legal responsibility. Failure of an examiner to take every reasonable precaution within his powers to detect disease has been the basis for action at law. And ophthalmoscopy is the one logical and practical means for eye men to arrive at intelligent diagnosis."

"It alone makes possible a thoroughly scientific eye examination, permits detection of diseases of the cornea, iris, lens, retina and choroid. Any one trained in ophthalmoscopy can readily recognize such afflictions as keratitis, iritis, cataract, optic atrophy, optic neuritis, syphilitic retinitis, choroiditis, hemorrhagic retinitis, diabetic retinitis, detached retina, glaucoma and many others. Use of the instrument is easily mastered, but complete diagnostic skill is acquired only after long experience . . ."

"Millions of people," they continue, "undergo eye examinations every year; probably the great majority needing only correction in refraction. But among these millions are many whose eyes would reveal, under ophthalmoscopic examination, incipient pathological conditions which medical attention would check or cure. It is safe to assume that the great majority of these do not suspect the existence of physical ailment and would not normally have an examination for symptoms of ill health. So the eye man is in a peculiar position to contribute to safeguarding public health through the use of the ophthalmoscope."

"Ownership and constant use," they conclude, "of the ophthalmoscope constitute genuine moral obligation upon every practitioner, for it gives definite information, whether pathological or refractive diagnosis is required. Potentially, it provides a safeguard to public health, increased scope for eye men to serve patients and greater prestige for practitioners."

Here is the authoritative word from that group of scientists who have at heart, only the best interests of the public at large. The message from which we have just quoted was written by these men for optometric consumption. It is clearly evident that these scientists believe that optometrists not only were in a position to do this work, but are doing it to the complete satisfaction of everyone, provided of course, that they have the modern instruments with which to do the diagnosing. And provided also that their training in their colleges or their subsequent graduate training in this department of their work, was such as to enable them to do this work properly. Regarding the former, let me say that the instruments are now available at such small cost that every qualified practitioner in the field of optometry can easily avail himself of one. Parenthetically let us add here that in a recent survey, conducted in a large Minnesota city there developed among other things, the information that more than 90% of all of the practicing optometrists of that community owned and used electrical ophthalmoscopes. Regarding the latter mentioned matter of training, as we will now show, our optometric educational centers have for many years been aware of these facts regarding the importance of ophthalmoscopy and are today doing an outstanding piece of educational work in preparing the optometrists of the future to continue to do this part of their professional clinical work with care, and with the greatest of skill.

The Educational Training of the Optometrists

In this report, mention has been made of the educational training received by optometrists in the universities and colleges that teach this specialty. Not only has it been stressed that the optometrist has the very finest of educational backgrounds when it comes to the examining of the eye with the correcting of refractive errors in mind, but it has also been pointed out that his educational training was such as to enable him to do a thorough piece of diagnostic work in the important matter of detecting those eyes in which there was some evidence of either general or ocular pathology. In these few pathological cases the optometrist does nothing more than refer the patient to a physician or oculist for further attention.

Let us therefore review some of the class room and clinical work given the student in optometric colleges or in optometric courses in our universities. Let us consider particularly this subject and the practical study of the problem here under consideration. The problem is the optom-

etrists' ability, as he is now trained, and using his present methods of diagnostic and refractive procedures to diagnose or differentiate the pathological eye from the one having no sign or symptom of pathology.

Before going into the educational training now being given optometrists, let us briefly review the facts already presented, in which we have outlined, first, the public's interest in this matter. Next, the legal side of this part of public health service, and third, the professional optometric phase of the question. Here we have proved beyond any possibility of doubt (1) that the optometrist is aware of his responsibility regarding the diagnosis of pathology, and (2) that for a number of years optometrists have used every worth-while technique at their command to fulfill in as perfect a manner as possible their fullest responsibilities in this regard to the public they serve.

We have also submitted expert medical evidence that (3) the interior of the eye can be successfully examined without resorting to the use of a mydriatic or "drops." This fact has been, of course, known to optometrists for a long period and the technique used by this group in doing this diagnostic work have been carried on with skill and the greatest of succcess for a large number of years. We have also submitted (4) medical evidence as to the optometrists' ability to successfully do this diagnostic eye work as well as the (5) scientific evidence which proves the same point. Let us therefore consider the educational qualifications and training of the optometrist.

Let us look first at the optometric work presented at Columbia University, Morningside Heights, New York City. From their 1936-1937 announcement of PROFESSIONAL COURSES IN OPTOMETRY, pages 29-32, we reprint the following outline of class work courses presented to optometry students in the third and fourth years of the optometry course at this educational center. The subjects outlined below represent somewhat *less* than one-half of the total courses given to student optometrists during their last two years at the school. Only these particular courses are presented here, as these have a bearing on the subject under discussion in this paper. These courses indicate the thoroughness of the diagnostic and refractive training given optometrists at Columbia University.

Physics 27-28—Physiological Optics. 3 points Winter Session; 2 points Spring Session. Professors Southall and Treleaven.

"Winter Session: Anatomy and dioptrics of the eye, including the schematic eye, ophthalmometry, ophthalmoscopy, skiascopy, accommodation, entoptic phenomena,

anomalies of refraction (myopia, hypermetropia, astigmatism, etc.), visual acuity, etc."

"Spring Session: The sensations and preceptions of vision are discussed more or less thoroughly as far as possible, including daylight vision, twilight vision, color vision, monocular and binocular vision, stereoscopic vision, kinematics of the eye, convergence, strabismus, optical illusions, empirical and nativistic theories of vision, together with constant reference to the history of these matters."

"The accompanying laboratory work consists of experimental studies of the phenomena that are of special interest for oculists and optometrists; for example, measurements by means of reflex images in the eye with the ophthalmometer and ophthalmophakometer; after-images and flicker phenomena; stereoscopic experiments; perimetry; stereoscopic campimeter; tropometer, etc."

"Textbooks: Tscherning, Physiological Optics, with continual reference to the English translation of Helmholtz Physiological Optics and other standard works."

Optometry 35-36—Anatomy and Physiology of the Eye. 3 points each session. Dr. Woll.

"The purpose of this course is to give the student a thorough knowledge of the anatomy and physiology of the eye. It consists partly of lectures and demonstrations and partly of laboratory work in which each student does his own dissections; so that at the conclusion of the course he must present actual specimens of dissections of parts of the eye."

"Textbooks: Huxley and Lee, Elementary Physiology; Woll, Technique of Eye Dissections."

Optometry 37—Introduction to the Theory and Methods of Optometry. 2 points Winter Session. Dr. Woll.

"This is a lecture course which is intended to present a kind of bird's-eye view of the scope and extent of optometry as a whole, especially in its relations to other branches of ophthalmology. It begins with a brief review of the history, development, and progress of optometry, but the greater part of the time is taken up with elementary instruction in methods and instrumentation, and it concludes with some reference to the present status and importance of optometry in the affairs of life, professional ethics, etc., the purpose being to afford a general preliminary idea of the practice of optometry."

Optometry 39-40—Theory and Methods of Optometry. 3 points each session. Professor Treleaven.

"In this course of lectures and demonstrations, which forms a continuation of Optometry 37-38, emphasis is laid on the important features of a complete ocular examination by the methods of optometry. From the beginning special attention is bestowed on symptomology and more advanced testing of extrinsic and intrinsic ocular functions and their mutual interrelations; perimetry and campimetry tests are demonstrated and studied in detail. Particular consideration is bestowed on the treatment of unusual conditions (such as strabismus, anisometropia, etc.); and also on the fitting of spectacles, especially in cases where Punktal, Katral, Contact, telescopic or bifocal lenses are needed. Critical comparisons are made of different methods of eye-testing, and many illustrative cases are discussed. Special instruments are demonstrated and studied such as slit lamp, refractors, etc."

"Prerequisites: Physics 21-22, Optometry 37-38 and Optometry 41-42."

Optometry 41-42—Practice of Optometry. 2 points each session. Messrs. H. R. Barnes and Hirschberg.

"This is essentially a laboratory course in conjunction with Optometry 37-38. The instructor tries to see that each student obtains here as much practice as possible in actually making optometrical eye examinations and in the correct procedure. This practical work begins first with a schematic eye and later the students examine each other's eyes, according to the methods which they have been taught in Optometry 37-38."

Optometry 43-44—Practice of Optometry. 1 point each session. Mr. H. R. Barnes.

"This course, which is a continuation of Optometry 41-42, is closely coordinated with Optometry 39-40, being the laboratory completion of the latter. The main object is to train the student as thoroughly as possible in the technique of each single step in the procedure necessary for making a complete optometric examination. In the Winter Session particular attention is bestowed on the subjective methods of sight-testing. In the Spring Session he is ready to study more complicated problems of binocular vision and to compare and evaluate the various methods of obtaining optometrical findings."

Optometry 49-50—Optometrical Laboratory. 3 points each session. Professor Treleaven and Mr. Roberts, with the assistance of Messrs. H. R. Barnes, Blackham, Hirschberg, Finkelstein, Avignone, C. D. Barnes and Tocher.

"This laboratory, which continues throughout the senior year, is closely related to the parallel courses in the practice of optometry. Here the student learns to make complete optometrical examinations under the guidance of experienced instructors. The patients are bona fide cases."

Prerequisites: Physics 21-22, Optometry 35-36, 37-38, and 41-42.

Optometry 45-46—Pathological conditions of the eye. 2 points each session. Dr. McKeown.

"This course aims to give the student careful and detailed instruction in the recognition of the normal state of the eye, and in the differentiation between healthy and pathological condition. Some attention will be bestowed on the hygiene of the eye. No attempt is made to give a training in the treatment of disease."

"Prerequisite. Optometry 35-36."

Next let us review the optometric work presented at the Northern Illinois College of Optometry at Chicago. From their 1935-1936 announcement of *Professional Courses in Optometry*, pp. 15-22 we reprint the following outline of class work courses presented to optometry students in this private college. The subjects outlined below represent somewhat *less* than one-half of the total courses given to student optometrists at this institution. Only these particular courses are presented here, as these have a bearing on the subject under consideration. These courses, too, indicate the thoroughness of the diagnostic work and the refractive training that is given to optometrists.

Biology 12. Two credit hours, first semester. "This course comprised a general survey of the broad phases of biology, including a study of the origin of life, the nature of evolutionary processes and eugenics. Instruction is by means of lectures, assigned reading and recitation."

Gross Human Anatomy and Histology 200. Five credit hours, first semester. "A study of the cell and its life processes, the histology of tissues and the gross anatomy if the skeletal, muscular, circulatory, lymphatic, respiratory and digestive systems. The student is required to make notes and sketches of the assigned subjects."

Physiology 211. Five credit hours, first semester. "This course and course 212 are intended to serve, jointly, as the basis for the study of (a) the physiology of the eye, (b) physiological optics, (c) pathology and (d) hygiene, especially personal hygiene. Physiology 211 deals with the physiological properties of protoplasm; cellular exchanges; muscle-nerve physiology; the blood and the circulation; lymph and lymph glands; respiration; foods, digestion and metabolism; heat production, distribution and loss. Methods of instruction include demonstrations and experiments performed in the classes, lectures, assignments and frequent oral and written quizzes. This course is collateral with Gross Human Anatomy and Histology 200."

Physiology 212. Five credit hours, second semester. "A continuation of course

211 which is prerequisite. Deals with internal secretions, kidney and skin elimination, reproduction, sense organs and the central nervous system. Methods of instruction, text and references same as for course 211 q.v."

Ocular Anatomy and Embryology 202. Five credit hours, third semester. "The anatomy and histology of the eye and its accessories. Includes the detailed gross and microscopic study of the eyelids, eyebrows, lacrimal apparatus, extrinsic ocular muscles, blood vessels, nerves and their pathways to the brain, other extraocular structures in the orbit, the tunics and other parts of the eyeball and the bones of the orbit. Embryology includes spermatogenesis, ovogenesis, maturation, fertilization, segmentation, gastrulation and the formation of the three germinal layers. From this point, special attention is devoted to the developmnt of the nervous systm and of the various parts of the eye and its accessories. Instruction is by means of lectures, assignments, recitations, demonstrations, charts and dissection. Each student is required to make complete dissections of the eye and its parts. These dissections, together with sketches of assigned subjects, are submitted to the instructor for criticism."

Physiological Optics 220. Four credit hours, third semester. "This course and its complement (221) deal with the structural and functional features of the human eye and the optic tract as they relate to the performance of vision. Course 220 includes a study of the optics of the human eye; accommodation; defects of the eye; structure and functions of the iris; extraocular muscles, conjugate movements, orthophoria and heterophoria, accommodation and convergence, binocular vision, stereoscopic vision, cortical visual centers, protective mechanisms, nutrition and visual efficiency. Instructions is by means of lectures, recitations, assignments, oral and written quizzes and a great variety of experiments and demonstrations performed in classes, a full description and explanation of which must be written by each student."

Physiological Optics 221. Four credit hours, fourth semester. "A continuation of course 220 which is prerequisite. Deals with stimulation of the retina; retinal irritability and adaptation; growth and decay of visual sensations; intermittent retinal stimulation; color vision; spatial and temporal induction, and theories of color vision."

Pathology and Bacteriology 230. Three credit hours, fourth semester. "This course treats of the fundamentals of disease; pathological processes; the nature of pathological changes in body tissues; the repair of wounds; infection, general and focal; degenerations; infiltrations: hypertrophy; atrophy; necrosis; blood pathology; circulatory pathology; edema; thrombosis; embolism; infracts; tumors or neoplasms, benign and malignant; pathology of syphilis, tuberculosis and rheumatism and a study of the general pathological conditions that are of special importance because of their effect upon the eye. The fundamentals of bacteriology are embodied in this course, including the classification and nature of bacteria; their morphology, products and effects upon the body tissues; asepsis, antisepsis, and immunology. Instructions is by means of lectures, recitations, charts, demonstrations and assigned readings and laboratory microscopy."

Ocular Anatomy (Advanced) 203. Three credit hours, fourth semester. "This course is a continuation of the course in ocular anatomy preceding it. It includes a detailed study of the eye and its relationship to the surrounding structures and to other parts of the body. The nervous and circulatory systems of the eye and its accessories are given in detail."

Theoretical Optometry 302. Five credit hours, fourth semester. "A continuation of 300-301. Runs concurrently with course 311 in practical optometry and instrumentation."

"A further study is made in heterophoria with special reference to harmony between intrinsic and extrinsic muscles; positive and negative relative accommodation; positive and negative fusional reserves; presbyopia and the prescribing of bifocal lenses; amblyopia, strabismus, diplopia, the horopter, fusion, stereopsis, suspension and suppression, anisometropia, perimetry, ophthalmometry, ophthalmoscopy, size of retinal image, glare, tinted lenses, bichrome subjective examination, cross-cylinder tests, malingering, etc. The purpose of each test is emphasized. All tests are critically analyzed, and the student is instructed concerning alternate tests and methods which may be employed.

In this course, the foundations are laid for case analysis. The principles of orthoptic exercises and visual training are introduced."

First Aid 75. Two credit hours, fifth semester. "While it is clearly recognized that all cases of emergency hemorrhages, contusions, wounds, dislocations, sprains, fractures, heat strokes, general freezing, insensibility, epilepsy, asphyxia and poisoning should have the immediate attention of a physician, and that the same is true in case of foreign bodies in the eye, ear, nose, throat, air passages, stomach, intestines or skin, it is nevertheless true that every layman ought to know the principles of first aid, and that an optometrist, by virtue of his title, may be called upon more frequently than the layman to act in an emergency. This course, therefore, is designed to teach the elements of antisepsis, hemorrhage control, ammobilication and antidotal technique."

Ocular Pathology 231. Five credit hours, fifth semester. "Recognition of eye-symptoms of disease is an essential part of the optometrist's training and this course is designed to render the student proficient in recognizing and identifying ocular pathological conditions and eye-signs of general pathological conditions. It consists of didactic and clinical study of diseases of the eye classified according to general pathology. It covers also pathological conditions of the nose and throat associated with ocular defects; the relation between systemic disorders and visual defects, and ocular diseases as related to refraction. The student has access to the resources of the college clinic in pathology."

Theoretical Optometry 303. Three credit hours, fifth semester. "An effort is made in this concluding course in the subject (see 300-301-302) to refine the theories and procedures previously learned by the student, and to weld them into a finished workable technique and a coordinated, systematic routine for the examination of the patient. Emphasis is placed upon history-taking and its indications, transvisualization, internal and external eye examinations, bearing of general health on refractive conditions, phorometry analysis, color field analysis and final disposition of the patient. In addition, subjects as illumination in relation to eye defects, evaluation of current literature and critical analysis of new instruments will not only give the student keener insight into optometry but will instill in him a desire to remain a student of the subject all his life. The lecture and discussion method of presentation is supplemented by material drawn from clinical cases."

Ocular Myology and Orthoptics 325. Three credit hours, fifth semester. "This is a lecture course which is supplemented by myologic work in clinical practice. After reviewing the anatomy and physiology of the intrinsic and extrinsic muscles of the eye, the student learns the fine points concerning binocular vision, stereopsis, the relation between the heterophorias and refractive condition. A thorough study is made of the principles underlying orthoptic training and the methods of relieving ocular discomfort. Much time is devoted to a study of the etiology and treatment of amblyopia and strabismus and, finally, the actual technique as used in the clinic, together with a review of cases, received group attention."

Clinical Optometry 330 (as Interne). Fifteen credit hours, fifth semester. "With this course, the student is introduced to the actual practice of professional optometry, and is brought into contact with bona fide patients presenting all types of eye cases and all ages and types of humanity. Patients are supplied by various relief and welfare agencies and by various public and parochial schools. Nearly all are charity cases. Clinic quarters comprise a patient reception room, three private consultation offices, fifteen examination rooms, a surgical amphitheatre accommodating forty observers, a biochemical laboratory, a dark room for orthoptic work, a vault for records and instruments, dressing rooms, coat rooms, lavatories, locker rooms and linen rooms. The clinical director's staff includes one assistant chief of clinic, from four to six staff associates, five associate chiefs of clinic (among whom are three physicians and one dentist) three registration and admission clerks and a variable number of clinicians and internes."

"The student enters his clinical internship thoroughly trained in the science and technique of optometry; but here he first makes contact with human sufferers. He is initiated into this contact by slow and gradual stages, the first of which is observation, the intern is permitted to take a history. Later, he makes an external examination, fol-

lowed in turn by internal examinations, phorometry, ophthalmometry, retinoscopy, field charting, etc. During this whole progress the student interne is under the close supervision of the clinician, and is subjected to the latter's rigid criticism. Weak points are quickly corrected, self-confidence is established, technique is perfected. Cleanliness, punctuality, accuracy and efficiency are stressed as cardinal virtues. At no time will more than two internes be found under the supervision of any one clinician. Marking is based on history-taking, determination of entrance condition, phorometry, ophthalmoscopy, ophthalmometry, retinoscopy, subjective examinations, dispensing, mental attitude, personal neatness, tactfulness in handling patients, dependability and application. There is one mid-term examination and one final examination, both written. All other work in the clinic is practical."

Case Analysis 305. Three credit hours, sixth semester. "In this course, the student is required to review and apply all of his previously acquired knowledge of physiological, psychological, pathological and theoretical optometry and to interpret the results of optometric tests and observations in terms of neuro-muscular and psychic responses to stimulation and contemporary neuro-muscular activity. He is taught systematic procedure for segregating significant test findings, and arranging the excessive, normal and deficient neuro-muscular response so that the causes of the patient's departures from normal may be most clearly recognized. How the component parts of absorption are determined from the test findings in demonstrated and systematized. Indications of the temporary or permanent nature of the immediate prescription are pointed out and classified. Indications of the need for exercises, optometric treatment or other than optometric services are studied and systematized. Various systems of case analysis are discussed and compared. Case records from the college eye clinic are utilized. This is entirely a lecture course whose practical aspects are found in its close alliance with the student's clinical experience, and its constant practical application to his work with his patients."

Clinical Optometry 331 (as Clinician). Fifteen credit hours, sixth semester. "This is the conclusion of course 330 (q.v.) and is the student's second semester in the clinic. He becomes, with the start of this course, a clinician. He is responsible for complete ocular examinations, including the prescribing, ordering, fitting and adjusting of glasses. He is also responsible for the correct training of one or two internes who are placed under his supervision and who look to him for guidance. He is thus made to experience leadership, and begins to manifest a marked confidence and superiority. During this semester, each clinician receives a total of not fewer than 500 patient visits—and as many more as he is able to handle without undue haste in any case. He is made to recognize that the visual welfare of each patient is always the first consideration. He is required and encouraged to take enough time in each case for a painstaking determination of existing conditons. Where pathological indications are present, the clinician refers his patient to one of the staff physicans or dentists, and follows the case through to its ultimate disposition. He is thus trained in the interprofessional cooperation which looks always to the best interests of the patient, and is a part of the code of every optometrist who is graduated from Northern Illinois College. By means of this disciplined daily practice of scientific optometry sustained over a clinical training period of nine consecutive months, with a concurrent upbuilding of the sense of responsibility and a whetting of the appetite for continued research, it is the purpose of clinical courses 330-331 to turn out men and women who are eager for the exacting duties of their chosen calling, competent to cope with any eye case that may be presented to them and imbued with that superb assurance which rests upon a smooth and facile technique backed by accurate and comprehensive scientific knowledge."

Clinical Pathology 332. Two credit hours, sixth semester. "This course parallels clinical optometry 331, and is designed to teach the clinician that while his primary interest is to complete each case from the optometrical standpoint, nevertheless many cases may and do have pathological involvements which impose a direct obligation upon the examining optometrist to refer them to one of the other professions among the healing arts. The schedule of special pathology clinics is as follows:

Monday . . . . . psychopathology
Tuesday . . . . . oral pathology

Wednesday . . . . . .ocular pathology
Thursday . . . . . .ocular pathology
Friday . . . . . .general medical diagnosis

These daily clinics are held in the surgical amphitheatre, and each is conducted by a competent man in the particular field concerned. The patient material presented in these clinics is produced through the findings of clinicians in their ocular examinations; and the clinician who refers a pathological case is required to attend the clinic where that case is presented, so that he may answer questions regarding his patient and observe the final disposition of the case. Thus he obtains the data needed to bring his own case to a conclusion, and also learns of the changes which may take place in the refractive condition of a patient after being operated, since re-examination of patients following surgery is obligatory."

The courses just quoted indicate the degree of thoroughness with which the optometric colleges and universities prepare and train the optometrist to diagnose ocular pathology, when this is encountered in private refractive practice. In this report but two of the many optometric courses are here quoted. Many others giving similar training could be included but the two herein given are presented, not because they are outstanding in this educational particular but rather as typical of the entire group of educational institutions giving this highly specialized form of professional training. As has been said before, the optometrist in his limited field, is the most highly specialized and the most minutely trained practitioner doing health work today.

In addition to mentioning the foregoing Educational activities, this report should also call the reader's attention to the fact that this Educational development in the field of Optometry is not limited alone to the profession in English speaking countries, but is rapidly becoming world wide. In this connection, let me refer to material recently received from Marvin J. Blaess, M.D.[3]

The eye section of the Seventh Congress of the Pan American Medical Association held its first meeting in Havana at 9:00 A. M. on Wednesday, January 19, 1938, in the Juan Santos Fernandez pavilion of the General Calixto Garcia Hospital which is the clinical teaching center for the medical school of the renowned University of Havana.

Following the papers on cataract surgery by Drs. Conrad Berens and Marvin J. Blaess respectively, Professor Carlos E. Finlay, one of the first and foremost ophthalmologists of Havana arose and presented a paper entitled "Relations of Optometry to Ophthalmology."

Dr. Finlay brought out the fact that optometry has been long

[3] Letter to Editor of the American Journal of Optometry, February 7, 1938.

established in Cuba; even antedating the medical eye specialist or oculist. The government of Cuba had recently decided that the interest of the people would be served best by a closer and better co-ordinated educational program for all types of eye specialists. A grant of money was therefore made to the University of Havana to establish within its educational domain a school of optometry with all necessary rights to confer appropriate degrees. Furthermore, a board of co-ordinating directors consisting of both oculists and optometrists was appointed and instructed to iron out all difficulties and differences of opinion and to define the limits of each educational program with a view to the future establishment of proper qualifying boards for each type of eye specialist. The plans point to the future limitation of all eye service exclusively to certified eye specialists.

During luncheon at the National Hotel, Dr. Blaess had a long personal talk with both Professor Finlay and Dr. Antonetti who is chairman of the board which is arranging the establishment of the school of optometry. This board of oculists and optometrists had encountered no unsurmountable difficulties and has already reached agreement on most questions of policy Dr. Antonetti said.

The concensus of opinion among both Cuban and American doctors with whom Dr. Blaess discussed this interesting and important matter was that it was the best and fairest method of bringing together two professional groups having similar interests. Some American oculists were exceedingly gratified to learn of this manner of solving a vexing problem and believe a similar program should be instituted in all American State Universities.

Dr. Blaess is particularly anxious to call this matter to the attention of all American oculists and optometrists who may learn much about professional consiliatory diplomacy by watching the developments of this important movement in Cuba.

Let us now turn our attention to another phase of this educational question, that having to do with the suggestions made to optometric colleges and educational officials conducting university courses dealing with optometry. These rules and suggestions were made by the Committee on Optometrical Education of the International Association of Boards of Examiners in Optometry. This powerful standing committee of that association virtually controls the educational practices of all institutions of learning already in this field or those attempting to enter

this field. This committee serves all State Boards in rating the schools and as no school can place its graduates before a state board for their strict final examinations unless the school has a very high rating given them by this committee, it at once becomes obvious that any ruling made by this committee must be put into effect at once by the schools. Regarding the training necessary to assure the public that the optometrist has the ability to diagnose ocular pathology, the committee has placed the following rules in effect pertaining to the training the student optometrist must get in the college or university some time during his four year stay at the school. We will quote from the FIRST REVISION OF OPTOMETRICAL SYLLABUSES AND STANDARDS as edited by Professor Frederic A. Woll. pp. 62-66.

Outline Syllabus on Diseases of the Eye. "For the present and perhaps for some time to come the work of the optometrist in relation to the diseases of the eye should be a relationship of normal diagnosis only. Therefore, this course must be built upon (a) general anatomy and physiology, and (b) anatomy and physiology of the eye. Those two courses should be prerequisites. In fact, it would be wise to regard elementary theoretical and elementary practical optometry also as requisites preceding the study of diseases of the eye, while physiological optics should be a parallel course. These recommendations are made in the interest of developing a clearer and more comprehensive understanding of so difficult a subject as diseases of the eye even when studied from the standpoint of normal diagnosis. . . . The course should include ocular pathology nomenclature, objective observation and subjective observation. These would be preceded by instruction in the relationships of optometrists to patient and to the ophthalmologist."

General Nomenclature of Pathology of the Eye.

A. Definitons: "Pathology, etiology, inflammation, suppuration, infiltration, cul-de-sac, tension, irritation, infection, malignant, congenital, lupus, congestion, gumma, hemorrhage, mydriatic, cycloplegic, tumor, cancer, bacteria, atrophy, hypertrophy, synechia, anesthesia, excision, incision, eruption, pulsation, cautery, traumatism, etc."

"The object of giving these definitions is obvious. The student in study of diseases must learn a new language. He must acquire a suitable vocabulary as soon as possible in order to readily understand his text book and the language of the instructor."

"In addition it seems very essential that instruction be given in the fundamental defenses of the internal tissues and tissue juices of the body. A discussion of phagocytic action, bacteriolysis, the action of antibodies, and immunity, passively or actively acquired should consume a considerable amount of time as preliminary to the study of the pathology of the eye."

Objective and Subjective Observation.

A. Objective Observation: "Examination with magnifying lens of all outer parts of the eye and its accessories. Use of ophthalmoscope: Exploration of the anterior chamber and lens, internal structure of the eye. Use of oblique illumination and magnifying lens. Use of trans-illuminator and magnifying lens. Careful location of all foreign bodies, opacities, or unusual conditions. Use of head mirror, binocular loupe. Explain possible meaning of general apparent characteristics. Eversion of lids. Use of slit lamp. Use of perimeter, campimeter and sterreo-campimeter."

B. Subjective Observation: "Past and present history of the patient concerning his habits, illnesses, use of drugs, tobacco, coffee, tea, etc. History of chronic illness or of possible family inherited tendencies."

Diseases of the Eye and Its Accessories.

A. Lids, Canthi and Accessories: "Blepharitis, meibomian cyst, warts, stye, 'black eye' trachma and other common diseases. These are to be discussed rather thoroughly. Other diseases such as ulcer, cancer, dacryoadenitis, etc., should be described and a superficial description of treatment and prognosis. Hygiene and advice should be indicated in the first mentioned group of diseases. The relation of errors of ocular refraction to certain diseases of the lids should be fully discussed. Use and abuse of poultices and compresses. The value of clean warm water with a small addition of boric acid. Diseases of the lachrymal apparatus. Traumatic injuries and their first aid treatment. Ptosis."

B. The Eye. "(a) Conjunctiva. Various kinds of conjunctivitis. The prevention of ophthalmia neonatorum as prescribed by law. This disease should receive the fullest discussion; at one time it caused more blindness than all other causes combined. Hay fever."

"(b) Cornea.. Various kinds of ulcers. Infections and inflammations, opacities and traumatism. Arcus senilis. Descriptions should include brief statement of treatments and prognoses."

"(c) Iris. Iritis of various kinds or due to various causes. Adhesions. Paralyses, different kinds of pupils and their causes. Pathologic conditions affecting the anterior chamber. Traumatisms due to accident or operation. Effect of various kinds of drugs."

"(d) Ciliary region. Tendency of diseases in this region to spread to other parts of the eye."

"(e) Lens. Various kinds of cataracts and their possible causes. Relation to focal infection. Dislocated lens and other traumatisms. Cataract extraction. Instruction and description should be thorough. Lens prescription after removal of lens. Possible use of protective glasses—colored glasses."

"(f) Choroid. Choroiditis due to various conditon. Atrophy. Relationships to the other disease and other parts of the eye. Prognoses. High myopia. Hemorrhages. Coloboma. Albinism."

"(g) Retina. Appearance in health; in disease. 'Yellow spot,' disc, atrophy, and all forms of retinitis. Detachment. Embolism and thrombosis. Snow blindness. Amblyopia. Scotoma."

"(h) Vitreous. Conditions as the result of other diseases of the eye. Traumatisms. Muscae volitantes. Foreign bodies, other opacities."

"(i) Optic nerve. General pathology of the nerve. Pathologic conditions of nerve and relation to appearance of disc. Inflammation, neuritis, atrophy, single or double, and effect of pathological conditions on sight."

C. Special Consideration: "Such diseases as cancerous condition of muscles or orbit, tumors of all kinds, gonorrhea, syphilis, paralysis, glaucoma, exophthalmos, etc. The effect of certain diseases, such as the venereal diseases, meningitis, diabetes, scarlet fever, measles, small pox, influenza, malaria, and the effects of alcohol and tobacco. Diseases of the lachrymal apparatus. Special consideration of the effect of certain diseases of other parts of the face in relation to sympathetic disease of the eye. The effect of cranial contusions, concussions, and fractures."

"Special attention to interpretation of symptoms pointing out resemblance of symptoms of sinus conditions, etc., to those of refractive and muscular anomalies. Also attention to differential diagnosis, particularly where the one may be a dangerous condition and the other more or less negligible, e.g., conjunctivitis, iritis, keratitis, muscae volitantes (as generally understood): keratitis punctate and vitreous opacities. Symptoms of focal infection from teeth, etc."

"Perimetric and campimetric indications of disease and of the commoner forms of toxemias, in particular Seidel's Sign, Bjerrum's Sign, Ronne's Nasal Step, also the effects of auto-intoxication and of alcohol, tobacco, quinine, coffee, arsenic, mercury, etc."

D. Hygiene and First Aid: "The care of the eye, from the standpoint of its

exposure to dust, dirt, wind and infection. A brief consideration of proper natural and artificial illumination. The use of hot and of cold compresses. The use of boric acid. Its abuse. First aid treatment in burns, acids, alkalis, foreign bodies, and blows. The removal of foreign bodies from the anterior surface of the eye (conjunctiva) and the lids."

In this manner the suggestions are made to optometric educators on the important matter of training optometrists in the diagnostic work of recognizing ocular pathology. These suggestions, coming as they do from members of various state boards of examiners serving on the educational committee and representing the state boards themselves, has had the effect as we have already shown of making our colleges and optometric courses at universities both conscious of this vital need and has assisted in the establishment of proper training in the diagnostic field for all optometrists.

Nor can it be sajd that this is something new in the matter of optometric training. The quotation just given from the FIRST REVISION OF OPTOMETRICAL SYLLABUSES AND STANDARDS edited by Woll, also appeared in the original REPORT OF THE FIRST CONFERENCE TO ESTABLISH OPTOMETRICAL SYLLABUSES AND STANDARDS, edited by Dr. William S. Todd, pp. 64-68, 1922. Published by the Department of Education of the American Optometric Association.

And it must be understood that while the committee suggested these minimum requirements back in 1922 that many of the colleges already had requirements in this matter of training in the diagnostic field, far beyond the suggested minimum. This was true then and is even more true now. Today every course teaching this specialty has given, and is now giving students a thorough preparation in the fundamentals of ocular diagnosis.

Not only do the universities and colleges prepare the students to do this diagnostic work, but the state boards themselves examine the applicant before granting him a license. This examination covers all phases of the refractive and diagnostic work the optometrist is expected to do and as it refers to diseased conditions it is both a written examination as well as a practical clinical one. No optometrist is permitted to practice until he has successfully passed a two day examination given him by his state board of examiners in optometry. In this particular, the optometrist is the only eye specialist who is examined by a state board and made to prove his proficiency in doing ocular work.

In addition to these matters, it should be pointed out at this time

that optometrists are trained not only in the recognition of ocular disease but also receive a very thorough training in the recognition of symptoms of general pathology as this relates to the eye or to symptomatology having to do with ocular work. In other words, our optometric colleges and our optometric university courses go much farther than the minimum requirement set up by the state boards of examiners. They do so in the effort to properly train the optometrist so that the public will be assured when using his services of receiving the best type of refractive skill and also in the event that there be evidence of disease that the optometrist will recognize it at once.

Summary

(1) The Problem.
  (a) It is conceded by all, that the present day optometrist is a specialist in the examination of the eye and the correction of refractive errors.
  (b) The problem discussed in this report has to do only with the training received by student optometrists in the matter of the discernment of ocular pathology and his ability to detect and diagnose abnormalities from normal, when these occur, and
  (c) the ability of the optometrist of today to make this examination and diagnosis, using his present techniques of examination and diagnostic procedures without resorting to the use of "drops" or mydriatics.

(2) Review of the professional duties of the optometrist.
  (a) to thoroughly examine the eye for
    (1) errors of refraction
    (2) imbalances of the accommodation-convergence relationships.
    (3) pathological departures from normal.
  (b) to correct abnormalities of the eye by
    (1) prescribing of glasses.
    (2) the prescribing of orthoptic treatments.
    (3) collaboration with the oculist in cases wherein pathology is either suspected or proven to be present.

The major portion of this report deals with the subject covered in (2-a-3) and (2-b-3).

(3) The techniques of examining the interior of the eye with the aid of the ophthalmoscope are discussed.
   (a) This examination procedure is one of the most important diagnostic techniques employed in the discernment of ocular disease.
   (b) Optometrists use this technique.
   (c) Oculists also use the technique.
   (d) Optometrists examine the interior of the eye without dilating the pupil.
   (e) Oculists, at times, dilate the pupil before examining the interior of the eye.
   (f) A number of oculists are quoted to show that a successful examination of the interior of the eye can be made without dilating the pupil by means of "drops" or mydriatics.

(4) Some favorable opinions by oculists are presented on the ability of the optometrist to successfully examine the interior of the eye without using "drops" or mydriatics.

(5) Some additional favorable opinions are presented on this same subject by a scientific technical staff.

(6) A part of the curriculum of two of the many optometric courses is presented to indicate the thoroughness in which this matter of diagnosis of ocular pathology is taught to student optometrists.

(7) The State Board examinations which the graduate optometrist has to pass before being granted a license to practice his profession is mentioned.

(8) The very strict supervision exercised over the optometric colleges and universities that teach this subject, by the International Association of State Boards of Examiners in Optometry is also mentioned and a few of the suggestions given by this body to the educational centers are quoted.

"In the controversy between some oculists and optometrists a great deal of skirmishing," claims Boatman, in THE OPTICIAN, Nov. 12, 1937, p. 256, "has occurred on what may be called the pathological front. These medical forces are skillfully manoeuvering to draw their opponents on to this ground and make it the scene of a decisive engage-

ment. Pathology is their own domain and naturally therefore they would like the issue (of who should do refracting) to depend entirely upon the question of recognition of disease. Everything is relative in this world and every practical solution is a compromise. No field of scientific activity can be severely limited and set apart from all others. Everywhere there is overlapping. The optometrist's training and practice centers around refraction, while the activities of the ophthalmic surgeon are directed towards pathology. The two fields touch, and slightly overlap —but they are essentially separate."

"Optometrists," continues Boatman, "realize this, or should. Their task," he claims, "is to bring it home with increasing clearness and forcefulness to others—especially to those with influence and authority. Some ophthalmic surgeons (oculists) have recently attempted to alarm the public by asserting: (1) that a very large proportion of those presenting themselves for eye examinations are suffering from some sort of eye disease; (2) that optometrists are not competent to recognize these diseases and refer them for treatment."

"The corollary is, of course, that these conditions are overlooked by the optometrist and that in many cases sight is impaired or lost through this neglect of incompetence. These assertions are bolstered up," continues Boatman, "with tendentious statistics. Very little consideration is necessary to perceive just how exaggerated they are. In 1927, Sir George Berry (honorable surgeon oculist to his Majesty the King in Scotland), speaking in the House of Commons, said: 'I admit at once that there is no reason why the public should not be assured of the service of properly qualified optometrists.[4] . . .. Ninety-five per cent of cases of eye trouble are cases of only optical defect. In point the skilled optometrist is perfectly competent to undertake the correction of optical defects.' Sir George was obviously stating his candid impression, based on his own long and varied experience. His estimate of 5 per cent of pathological cases has now been magnified up to 30 per cent or more by these recent medical controversialists; but the very extent of the disparity is a clear indication of bias. The higher figure," as Boatman points out, "is what one would expect, of course, for persons presenting themselves for eye assistance at a free hospital clinic, but even so it includes many minor conditions recognizable by the patients themselves, and within the prov-

[4] In England optometrists are called ophthalmic opticians or sight-testing opticians.

ince of the general practitioner. It also includes other conditions, for which no treatment can be given."

"If these oculists' contentions were true, a very large proportion of those who consult optometrists would suffer through neglected symptoms of disease. What is the common and plainly observable experience in this matter? Is it not well known that every reputable optometrist has a large nucleus of patients who loyally return to him at intervals, in due course bringing along members of their family, and recommending friends? Would they do this," asks Boatman, "if they were having trouble through neglected symptoms of disease? In many rural towns, for instance, a large proportion of the best-known and most influential residents have long been in the habit of obtaining their glasses on the advice of one or the other of the local optometrists. Generally speaking, they have been perfectly satisfied, and there has certainly been no scandal about their failure to recognize disease. Nor is there any desire on the part of the optometrist to prevent pathological cases from receiving medical treatment; on the contrary, the optometrist frequently has to use much persuasion to induce patients to consult an oculist, when in his opinion, this course is desirable."

Conclusion

(a) It has been shown therefore that a successful examination of the interior of the eye can be made without resorting to the use of "drops" or what is more properly called a mydriatic to dilate the pupil.

(b) It has been shown further that optometrists are trained to make this investigation of the interior of the eye, and also trained to diagnose existing abnormalities when found.

(c) It has been shown that a number of medically trained oculists feel, as expressed in their writings, that the optometrist can differentiate the abnormal from the normal eye when pathology is under consideration.

(d) It has been shown also that the optometrist must undergo a very strict examination on his proficiency in this diagnostic work by the state before he is permitted to practice.

(e) We must therefore conclude, that optometrists are educationally and technically able to perform in the field of differentiating the abnormal eye from the normal with regard to refractive errors as well as diseased conditions.

Carel C. Koch.

BOOK NOTICES

INTRODUCTION TO THE MATHEMATICS OF OPHTHALMIC OPTICS, by Paul Baeder, Ph.D. Published by the Distinguished Service Foundation of Optometry, 50 North Main St., Fall River, Mass. Two hundred forty-four pages, eighty-five illustrations, cloth cover, 1937. Price, $2.50.

In writing the book, *Introduction to the Mathematics of Ophthalmic Optics,* Baeder intended to present to the busy practitioner and student the fundamental mathematical principles and operations which are needed in the study of general and ophthalmic optics. The author tried to introduce the fundamental yet simple mathematical concepts. These he selected according to their importance in the practical application. The transition from the simple to the more difficult has been made very gradual, so that one who has no special mathematical knowledge will be in a position to follow the complete work.

The book is divided into three parts. The first part covers the entire field of arithmetic, the second part deals with notations and evaluations of formulas, and the third part covers trigonometry and geometry theorems and their application. The book is profusely illustrated.

The Distinguished Service Foundation of Optometry is to be congratulated for making this valuable work available to the profession. Copies of this book may be obtained from the secretary, Dr. Laurence P. Fulsum, South Royalton, Vermont. J. I. K.

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PAGE HEADINGS

The reason offered for using "drops"—Lack of controlled experimentation—Statements favoring the use of "drops"—The other side of the question—Statements opposing the use of "drops"—Dilation adds to difficulties—Oculists disagree on use of "drops"—A controlled investigation of the matter—How the idea of using "drops" started—Findings variable with different drugs—Controlled experiments by Tait—Variable results obtained when "drops" are used—Findings with "drops" of questionable value—Summary—"drops" should not be used—Optometric techniques require no "drops"—Clinical evidence against the use of "drops"—Refraction with "drops" mere guesswork—"Drops" are undependable—"Drops" are unnecessary and inaccurate—Danger and inconvenience of using "drops"—"Drops" shown to be unnecessary.